# CLAIMS

1. Blind or partially blind process to determine characteristics space-time parameters of a propagation channel in a system comprising at least one reception sensor receiving a signal y(t), characterized in that it comprises at least one step in which the specular type structure of the channel is used and a step for the joint determination of parameters such as antenna vectors (**a**) and/or time vectors ($\tau$) starting from second order statistics of the received signals.

2. Process according to claim 1, characterized in that it comprises a step in which the received signal is oversampled.

3. Process according to claim 1, characterized in that it comprises a step in which the signals are received on at least two sensors and a step in which the received signal is oversampled.

4. Process according to any one of claims 2 and 3, characterized in that the sampling period corresponds to T/p where T is the symbol period.

5. Process according to any one of claims 1 to 4, characterized in that it comprises at least the following steps:

- choose the length of the global propagation channel $\hat{L} \geq Lg + \Delta\tau_{max}$

and the value of the number of observations $K \geq \hat{L}$ where $\Delta\tau_{max}$ is the largest possible value of the relative delay between two paths

- determine the $Q_{\hat{L}}(\hat{R})$ matrix of the sub-space criterion,
- estimate the number of paths $\hat{d}$,

- estimate delays

$$\hat{\tau} = arg\ \min_{\tau} J_{\hat{L},\hat{d}}(\tau)$$

$$J_{\hat{L},\hat{d}}(\ \ ) = \frac{\lambda_{min}(G_{\hat{L},\hat{d}}(\tau)^H Q_{\hat{L}}(\hat{R}) G_{\hat{L},\hat{d}}(\tau))}{\lambda_{min}(G_{\hat{L},\hat{d}}(\tau)^H G_{\hat{L},\hat{d}}(\tau))}$$

- estimate the value of the antenna vector by $\hat{a} = vp_{min}(G_{\hat{L},\hat{d}}(\tau)^H Q_{\hat{L}}(\hat{R}) G_{\hat{L},\hat{d}}(\hat{\tau}))$
- form the estimate of the pulse response: $\hat{h} = G_{\hat{L},\hat{d}}(\hat{\tau})\hat{a}$

6. Process according to one of claims 1 to 4, characterized in that it comprises at least the following steps:

- Estimate $\hat{L}g$ the length of the transmission filter and choose $\hat{L} \geq \hat{L}g + \Delta\tau_{\max}$ *and* $K \geq \hat{L}$.
- Apply the sub-space method described in item 2 of the a priori process:
  - Estimate the covariance matrix $\hat{\boldsymbol{R}}$.
  - Calculate the projection matrix onto noise space $\hat{\Pi}_{\hat{L}}$ using the eigenvectors associated with the pq(K+1) – (K + $\hat{L}$+1) null eigenvalues of the matrix $\hat{\boldsymbol{R}}$ .
  - Form the matrix $Q_{\hat{L}}(\hat{R}) = D_{\hat{L}}(\hat{\Pi}_{\hat{L}}) D_{\hat{L}}(\hat{\Pi}_{\hat{L}})^H$
  - Obtain the $\bar{h}$ eigenvector associated with the smallest eigenvalue of the matrix $Q_{\hat{L}}(\hat{R})$ and form $\hat{h}_{\frac{T}{p}}(z)$
- Form the new parametric criterion:
  - Choose the value of the channel length R $\geq \hat{L}_{\frac{T}{P}}$ = p($\hat{L}$ + 1) - 1

And form the matrix $\tau_R(\hat{h}_{\frac{T}{p}})$

– Calculate the matrix $\hat{\Omega}_{\hat{L}_{\frac{T}{p}}}$ containing the eigenvectors associated with the q(R + 1) – (R + $\hat{L}_{\frac{T}{p}}$ + 1) smallest eigenvalues of $\tau_R$

– Form the matrix $D_{\hat{L}_{\frac{T}{p}}}(\hat{\Omega}_{\hat{L}_{\frac{T}{p}}})$

- Estimate the number of paths $\hat{d}$,
- Determine a minimum value of the transmission filter band: B,
- Choose $\tilde{v}(t)$, a continuous filter with a limited band B. Form the filter v(t),

$$\begin{cases} v(t) = \tilde{v}(t) & 0 \le t \le Lv \le \hat{L}g \\ v(t) = 0 & \text{elsewhere} \end{cases}$$

- Estimate the delays

$$\hat{\tau} = arg\ \min_{\tau} I_{\hat{L},\hat{d}}(\tau)$$

where

$$I_{\hat{L},\hat{d}}(\tau) = \frac{\lambda_{min}(V_{\hat{L},\hat{d}}(\tau)^H D_{\hat{L}\frac{T}{p}}(\hat{\Omega}_{\hat{L}\frac{T}{p}}) D_{\hat{L}\frac{T}{p}}(\hat{\Omega}_{\hat{L}\frac{T}{p}})^H V_{\hat{L},\hat{d}}(\tau))}{\lambda_{min}(V_{\hat{L},\hat{d}}(\tau)^H V_{\hat{L},\hat{d}}(\tau))}$$

- Estimate antenna vectors:

$$\hat{a} = vP_{\min}(V_{\hat{L},\hat{d}}(\hat{\tau})^H D_{\hat{L}\frac{T}{p}}(\hat{\Omega}_{\hat{L}\frac{T}{p}}) D_{\hat{L}\frac{T}{p}}(\hat{\Omega}_{\hat{L}\frac{T}{p}})^H V_{\hat{L},\hat{d}}(\hat{\tau}))$$

7. Application of the process according to any one of claims 1 to 6 to monitor the spectrum of a propagation channel for positioning purposes from one or several HF stations.

8. Application of the process according to any one of claims 1 to 6, for the standard communication links for equalization or positioning or spatial filtering.